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AUTHOR Wilson, Kenneth G.
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ABSTRACT

The National Goals for Education signal a new paradigm. To strengthen this paradigm, a 20-year apprenticeship, starting in the fifth grade, is proposed for all future teachers and professors (in fact, all students, regardless of career goals at that time). Twelve years of peer tutoring experience for virtually all students would begin this apprenticeship. Also, an emerging set of education planning professions (such as instructional design) would support learning by all students through a periodic and comprehensive redesign process. Method of instruction, where to start, evaluation, and the research university are also addressed. Two positive feedback loops, one being apprenticeships for future teachers and professors and the other a redesign process based on field testing of plans including professional development planning and evaluation based on classroom assessment and student experience, would ensure continuing educational advances. Assessment would be an essential component of the new paradigm. The plan is offered to focus nationwide debate on remaining needs for a completed new paradigm. Two tables illustrate the discussion. (Contains 34 references.) (SLD)

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Wisdom-Centered Learning: Strengthening a New Paradigm for Education

Kenneth G. Wilson

The National Goals for Education signal a new paradigm. To strengthen this paradigm, a twenty year apprenticeship, starting in fifth grade, is proposed for all future teachers and professors. Twelve years of peer tutoring experience for virtually all students would begin this apprenticeship. Also, an emerging set of education planning professions, (such as instructional design,) would support learning by all students through a periodic and comprehensive redesign process. Method of instruction, where to start, evaluation, and the research university are addressed, too. Two positive feedback loops would assure continuing educational advances. The plan is offered to focus nationwide debate on remaining needs for a completed new paradigm.

The author is in the Department of Physics (and the College of Education), Smith Laboratory, The Ohio State University, 174 W. 18th Avenue, Columbus, OH 43210

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Introduction

Economic driving forces have led to yet another new start on education reform, beginning with the 1989 Education Summit, which former President Bush and current President Clinton both attended. There is bipartisan support for the six National Goals for Education agreed to by the Summit, including the goals that all students meet high academic standards and that all adults are ready for work and citizenship*(1)*. Unfortunately, the present education system in the United States has fundamental weaknesses, starting with teacher education, that have to be overcome before the National Goals can be realized. No credible solution for these weaknesses currently exists, as has already been made clear in key references for this paper*(2)*.

Two and one-half years ago, colleagues from Miami University of Ohio, the Ohio Board of Regents, the Ohio Department of Education, and I initiated Project Discovery, an education reform project in Ohio*(3)*. It was charged by the National Science Foundation to begin immediate partial implementation throughout Ohio of those National Goals specifically addressing mathematics and science education. Shortly thereafter, it became clear that to respond to this charge for the long-term, I had to understand the weaknesses of the entire United States education system, kindergarten through college, in all subjects. In order to understand this system, I had to immerse myself in the world of social science research on education, having been guided to literature of extraordinarily high quality and depth which was totally new to me. My guides

were both education faculty at The Ohio State University*(4)* and the social scientists on a study committee I joined at the National Academy of Sciences*(5)*.

The research that I studied paints a far grimmer picture of United States education than I was aware of. Firstly, it showed that money alone cannot solve our problems. The reason for this conclusion is that some of the deep problems which afflict financially-strapped inner city schools are also found in Ivy League science departments, as well as in private schools educating the sons and daughters of billionaires. Besides teacher education, these problems include the poor quality of texts and materials, the fast pace of the curriculum, the hopelessly inadequate advanced planning and preparation for classroom instruction, and inadequate assessment. These problems are in addition to the financial problems which contribute to large class sizes and decaying physical plant, and the societal problems which especially afflict disadvantaged minorities. Secondly, there are no feedback loops in the system powerful enough to bring about constructive change; instead, there is massive inertia which maintains the status quo. But the real shock, for me, was to learn that the problems of educational reform have no known solution, for any price, despite centuries of thought*(2)*. Instead, these problems constitute a social scientist's analogue of Fermat's Last Theorem (a classic and still unproven challenge in mathematics).

Fortunately, I find that the situation in current education can be characterized not as a hopeless mess but rather as an outdated paradigm of schooling and school reform, just as Copernicus found that the earth-centered Ptolemaic model of the solar system was inadequate*(6)*. The goals behind the current paradigm for education were set around 1900, when the function of school was

to prepare most students for rote, low-skill jobs in factories, with only a small elite selected (by the grading system) for entrance to high school, college, and a subsequent professional career*(1)*.

In contrast, the function of school today is to prepare students for life-long learning and living in a complex, diverse, technological, democratic society. Each state already has begun to build a new paradigm to address this new function as their response to the National Goals for education*(7)*. I found a lot of clues to what is needed to strengthen the new paradigm, partly from the research studies (including one comparative study with the Far East*(8)*), partly from four long-standing educational reform projects whose leaders all have twenty or more years of experience in reform, and partly from my own past experience with scientific and technological paradigm shifts.

However, I am not able to follow the lead of Copernicus and announce the completed new paradigm for United States education. Such a paradigm has to be built by a collective process engaging teachers, students, school administrators, parents, education faculty, and many other constituencies in each state, all of whom have more experience than I. Moreover, many people's lives would be greatly changed by any widely adopted new form of education, which makes it doubly important that they be consulted about such changes, to ensure changes meet their needs. Instead, I have gone through a "dress rehearsal" for constructing a new paradigm to fulfill the National Goals. I have reduced a very complex human problem to the relative simplicity of a physicist's frictionless inclined plane. In particular, I have neglected problems that are unique to individual schools or districts, considering only a few key problems that have persisted for centuries and are ubiquitous in all levels of education

and all parts of the country. This restriction is essential to enable readers to build an initial understanding of the new paradigm. The principal references for this paper do not make the same simplification; the reader should find this paper a useful starting point to benefit from the deep understanding embedded in these references.

Table I compares selected components of the old and new paradigms for education. In the remainder of this paper, I discuss the following aspects of a new paradigm: teacher education; method of instruction; planning and quality; where to start (on the road to the new paradigm); evaluation, feedback, and proliferation; and research universities. Two positive feedback loops are proposed - one in teacher education, one based on planning. Table I presents the components of the new paradigm that are discussed below and contrasts them to the old paradigm now dominant.

All the components I discuss are important to achieve equity in our educational institutions. In addition, natural yet especially powerful roles are suggested for disadvantaged minorities in evaluation and in getting started. These roles are central to success or failure of the entire paradigm for all Americans, not just minorities.

Teacher Education

In the outdated paradigm, teacher education begins and ends in college. However, teachers themselves often report that they learned more about teaching in their classrooms than in college*(9)*. Furthermore, there was a constant refrain about teacher education in virtually all the research I studied, as

well as my personal experience with reform. The refrain was that education reform could not succeed without endless professional development for teachers on the job*(2)*. There were many different melodies contributing to this refrain.

> One theme was the need for deeper understanding of the subjects they teach so that teachers could encourage and respond effectively to student questions. For teachers with elementary school certification (found teaching in both elementary and middle school), this meant sufficient expertise in <u>all</u> elementary and middle school subjects, starting with mathematics, all sciences, history, social studies, reading, and writing--a range of expertise few of them have now*(10)*. This expertise would take many years to acquire; college is not long enough.
>
> Another theme was learning expert classroom management, which devastates an isolated beginning teacher, especially if he or she is in an inner city school*(11)*. It requires the skills of an orchestra conductor to manage a class of thirty students to ensure <u>all</u> are learning simultaneously (even in college). We prepare orchestra conductors through lengthy apprenticeships, not in college lecture halls.
>
> A third theme was mastering a multi-cultural, multi-language, multi-ability classroom (when teachers talked to me about this, their parting shot was ". . . and the crack babies arrive next fall.") Again, this mastery requires practice and guidance to achieve*(12)*.
>
> A fourth theme was coping with intense time pressures caused by the crushing burden of five or more hours of class per day and very little time for professional activities, class preparation, and the like*(2)*. Stevenson and Stigler*(8)* report that throughout the Far East, teachers had three, or at the most four, hours of class a day--the latter only for teachers in a single self-contained homeroom,

> rather than separate classes. The Far Eastern teachers were incredulous when informed of the United States class schedules for teachers, implying that this lack of time for professional development and planning activities cannot be overcome even with practice.
>
> The fifth theme was coping with the adult organizational environment of schools, including interactions with parents and principals, as well as endless administrative tasks, which take time away from teaching*(2,12)*.

While there is an infinite need for professional development, there is currently only a finite amount of money to pay for it. For example, in Project Discovery we promised the National Science Foundation (NSF) that we would provide six-week long summer institutes in mathematics, physical sciences, and life sciences for middle school teachers, with ongoing academic year professional development follow-up sessions*(3)*. But NSF was supplying a maximum of two million dollars a year for a maximum of five years, with matching money from the state, and this was not enough to supply a six-week institute to every middle school teacher in Ohio who would benefit. Thus, there was immediate political pressure on us to offer two-week programs to three times as many teachers. Yet, my study indicated that even six weeks was still far too short to attain the prerequisite understanding of content.

To make matters worse, one National Goal for the United States is to be first in the world in mathematics and science by the year 2000. This means doing even better in mathematics than the Far Eastern elementary schools that Stevenson and Stigler studied*(8)*, schools that far surpass the United States in mathematics achievement. They found that part of the reason for success in the

Far Eastern schools was that their teachers had professional development sessions built into their weekly school schedule, continuing throughout their entire career. Moreover, the teachers reported that they really learned to teach in these professional development sessions, rather than in college. Finally, Stevenson and Stigler found that Far Eastern teachers provided far superior teaching to their students than the United States teachers who were also observed. The Far Eastern teachers produce very carefully planned lessons, sometimes around a single mathematical problem, giving students time to think and time to propose alternative ways of solving the problem. The teachers utilize problems that have been handed down and polished through many generations of teachers rather than created the night before class.

To provide United States teachers with the same sustained professional development and interchange that Far Eastern teachers have, along with a workable daily schedule, would require cutting down United States teaching schedules to the same three or four hour limit found in the Far East. This is not a money problem because the Far Eastern type schedule is universally absent from United States schools despite their very wide range of budgets. Instead, the problem is that no credible plan for this wholesale change of teaching schedule exists that United States school administrators could adopt at budget time when these administrators are also overwhelmed by proposals for smaller, piecemeal reforms, each backed by a limited but vocal constituency*(2)*. This problem will be addressed in later sections, especially **Where to Start**.

In building a new paradigm, my strategy was to start with the need for lifelong school-based professional development as already found in the Far East, and then ask how to reorganize schooling so that it would become not too

expensive and also would be politically stable, i.e., widely accepted as essential, rather than a luxury that can be eliminated whenever there is a budget cut or a change of school or government administrators. Fortunately, a remarkable book*(9)* by a sociologist, Dan Lortie, provided the clues I needed to address this goal, and I state the result.

In the new paradigm, all potential teachers and professors would spend roughly twenty years as guided apprentices before being examined and certified as fully professional teachers*(1)*. The twenty year period would begin early in school, where all students (regardless of their career goals) would spend part of their time (perhaps 12-20%) involved in peer tutoring*(13)* and other teaching functions. The students would receive guidance and formal instruction from faculty to help them coach other students successfully. They would thereby learn teaching skills needed for the workplace*(1)*, parenting, and active citizenship. They would also build deeper subject matter understanding through teaching it. This apprenticeship would continue through college, constituting roughly twelve years of the twenty year process. Then the first eight years on the job, whether as a graduate student teaching assistant or a faculty member in school or college, would complete the apprenticeship for intending professionals. Combined with the apprenticeship, potential school and college faculty would spend several years gaining experience in work settings appropriate to their future students.

The long apprenticeship is necessary so that faculty at all levels combine the depth of a thorough college major with a breadth of natural and human understanding. They would build through their own apprenticeship not just the wisdom of the village elders of old, representing a single community, culture, or

subject specialty, but rather a more global wisdom encompassing many components of our complex society. Faculty need this level of depth and breadth to guide and counsel students who are building an integrated set of workplace, living, and citizenship skills. They need it even more to guide apprentices, some of whom will be their successors.

How can a twenty year apprenticeship be politically stable? First of all, it has to make sense to the apprentices, to the faculty who guide them, and to the public. That is, all three constituencies must see that the apprentices actually require twenty years to master all major aspects of their profession, to learn what sociologists call the "technical culture"*(9)* that is shared among established professionals. For example, I studied the oboe for several years and had no doubt that it could have required twenty years of intensive practice to become a first chair oboe player in a major orchestra. Moreover, a profession that requires a twenty year apprenticeship generally earns a lot more respect than one that does not, and that respect can help sustain the length of the apprenticeship. I do not know that twenty years is exactly the right length of time to meet this criterion, but I suggest it as a ballpark number.

Secondly, the long apprenticeship would be even more stable if it enabled fully established teachers to outdo unsupervised apprentices in several respects: guiding students and apprentices to high personal and academic achievement, succeeding with virtually all students, not just the subset with high ability, and yet being more efficient--requiring less time to bring about these achievements. The Far Eastern teachers that Stevenson and Stigler studied succeeded in all three respects, including being efficient when in class because of their large class sizes*(8)*.

In building the rest of the new paradigm, I have put heavy emphasis on achieving lowered unit costs simultaneously with high quality and high reliability. By unit costs I mean the costs of having one student achieve a set amount of learning. Lowered unit costs is one key missing ingredient in past reform efforts. Lowered unit costs are needed to ensure growth of the new paradigm despite a system politically committed to the old one. Lowered unit costs does not mean an overall loss of jobs in education. In fact, quality improvements combined with lowered unit costs are much more likely to generate jobs than lose them*(14)* because of the unmet educational needs (i.e., workforce retraining, adult education) of our society.

Method of Instruction

The new paradigm I developed for teaching and learning in school and college differs from current practice in many respects. I report only three examples here. First, in the old paradigm, students are mostly lectured at and mostly compete as individuals for a limited number of high grades. In the new paradigm, students coach each other to learn as they build workplace and living skills as teams. Much of this coaching would occur in a "learning unit" consisting of a group of several students around a table with a more experienced student acting as a peer tutor or teacher's helper. To complete the learning unit, there would be classroom supplies and a networked, personal computer (see discussion in Planning and Quality) on the table. There is already a well researched reform called "cooperative learning"*(15)* which can be used to organize the group of students (in school or college) so that they

work cooperatively and encourage each other to learn, in or out of the classroom. Cross-age peer coaching has also been extensively researched*(13)*.

Second, in the new paradigm, teachers would no longer be exhausted by their daily schedule or wind up trying to succeed with only a few students. Faculty in schools, colleges, and universities would have a new set of priorities in their daily schedule. Their top priority would be ongoing collaborative professional development to improve their teaching skills; in turn they would spend time guiding junior colleagues, peer tutors, cooperative learning groups, and perhaps other volunteers in their teaching responsibilities. The ongoing professional development would be aimed partly at helping faculty make very effective use of the time they do spend teaching, as well as preparing them for their unfamiliar teacher-education-type responsibilities. A fair amount of this time would still be spent with students (such as the peer tutors) but in a new, more collegial relationship. Direct classroom teaching would be their second priority, but the total time they spend in direct teaching plus classroom related functions would be substantially reduced to make room for the new top priority. This reduction in teaching time would be compensated for by the vastly greater amount of teaching (coaching) which the students would be providing to each other. Each student would get hours of attention, mostly from fellow students, instead of the meager minutes of individual attention given the typical, unfavored student in today's classrooms.

Third, much of the teaching would actually be coaching rather than lecturing*(7)*. As a foundation for learning all academic subjects, the higher order skills required for work (or for living and citizenship), from critical thinking to

mathematical problem-solving, to written and oral communications would be learned along with interpersonal skills and values through constant practice*(1)*. Students often are bored and alienated by the constant rain of disconnected facts and formulae in school textbooks and standardized tests in most classes*(16)*. The higher order workplace skills to be taught in the new paradigm should be far more satisfying to learn and far more useful to students. This focus on higher order skills would be a generalization from the interpersonal skills that are already taught in research-based models of cooperative learning*(15)* and peer coaching*(13)*. Furthermore, the questions all students bring with them to kindergarten that are currently suppressed early in elementary school, due to slavish adherence to scheduled curriculum, would be encouraged and nurtured in the new paradigm by wise teachers and fellow students*(17)* . The students, in particular, would play a leading role in providing personal attention and encouragement for each others' efforts. With its emphasis on higher order skills and high academic achievement for all students, the new paradigm is aligned with the National Goals .

Impact of Planning on Quality

One of the most serious problems I found with United States education is its inability to provide students with learning experiences of quality*(18)*. An example of a quality experience is reading an interesting story instead of memorizing vocabulary. Another example is finding many ways to solve a challenging mathematical problem rather than plugging numbers into a memorized formula. A third example is providing student teachers with a coherent sequence of guided inquiry lessons in electricity, enabling them to build operational understanding of current, voltage, and resistance, instead of

requiring them to plug numbers into Ohm's Law*(19)*. A fourth example is having students experience examples of each new idea (such as "fraction") before they learn the name for the idea, instead of being forced to memorize jargon that makes no sense to them*(20)*. (When I visit science classrooms where there is talk of "atoms," I like to ask the students what this word means to them. I usually get a blank stare in response.) A fifth example is asking hard questions in class and giving time for students to think through a response, instead of asking simple memory-based questions and expecting a rapid response*(8)*. Quality also means, more broadly, that the arts and human concerns have an equal role with intellectual learning: see, e.g., Silberman*(2)* and Sarason*(16)*.

As noted earlier, Stevenson and Stigler*(8)* found that the mathematics teaching they observed in the Far East met many of the requirements of quality while the teaching they observed in the United States did not. The United States priority was rushing through curriculum as rapidly as possible with no slowing down to achieve quality. They also found that improving quality was a major focus of the weekly collaborative professional development sessions of Far Eastern teachers, sessions which are unavailable to most United States teachers and professors.

There are two sources of quality in the classroom--quality in the teaching itself and quality of advanced planning: everything that happens in advance but affects classroom teaching and learning. "Advanced planning" includes: professional development of faculty; development of materials, software and supplies; establishment of classroom rules and organization (such as the organization and training of learning units); examples prepared in advance for classroom lessons; parental encouragement of learning; and school budgeting

(for supplies, teachers/student ratios, professional development, etc.). What I found is that virtually all advanced planning is poor throughout the United States education system.

In many cases, the poor quality of advanced planning is the result of poor design--from poorly written textbooks to inadequately tested reform plans to superficial "packaged" staff development sessions*(2)*. Design improves incrementally with classroom testing and careful revision. Unfortunately, most designs are brought to the classroom with grossly inadequate testing and revision. In contrast, the leaders of the more successful reform programs have focused on building quality into their plans with repeated testing and revision taking as many as twenty years for refinement. My studies indicated that this extended testing was a necessary prerequisite for all students to learn and understand challenging discipline content. Besides cooperative learning*(15)*, other reforms I studied included Slavin's nationwide school restructuring program called "Success for All"*(21)*, normally cited with those of Comer, Sizer, and Levin*(22)*, as well as two more specialized reforms called "Physics by Inquiry"*(19)* and Reading Recovery*(23)*. In the process of developing and refining their programs, the leaders of these reforms were establishing new "education planning" professions with professional standards for quality.

The new paradigm for education would delegate leadership of demanding planning and testing activities to "planning professionals", and not leave it to ill prepared outsiders, nor even to faculty unless they have the time and the extra

preparation these professions require. The list of education planning professions(*24)* includes:

- educational architect, responsible for the development and full testing of new organizational structures for learning, such as cooperative learning;
- instructional designer, responsible for the development and full testing of specific learning experiences for use in coached instruction, along with supporting materials and professional development expertise to help faculty take advantage of these experiences;
- teacher-leader, an exemplary teacher who becomes a leader of professional development;
- content-educator (generalized to all disciplines: e.g., physics-educator, mathematics-educator, English-educator, etc.), a person who becomes an instructional designer or leader of professional development but brings deep disciplinary understanding to either profession; and
- change facilitator, someone who leads the effort to help a whole organization undergo change.

Then there is a very special planning profession I call "education systems integrator" whose purpose is to draw together a multitude of reform plans into an overall system design that expands to encompass more and more schools over time. Marie Clay, the designer of Reading Recovery, and Robert Slavin, the designer of "Success for All", are the two education systems integrators I have met. It requires exceptional talent and experience to become a successful education systems integrator, as will become evident below.

Teaching is itself partly a planning profession, and there are others. There is educational evaluation, illustrated in Stevenson and Stigler's work*(8)*. Then there are the administrative professions which I call planning professions because their work on budget, classroom design, etc., occurs in advance of classroom activities. Likewise, parents and their support of their children affects later classroom and out of class learning; thus, I believe the role of parent has to be regarded as a planning profession, too. One should also not forget*(2)* the roles of school board member, government agency head or staff, and politician, all of which contribute to the success or failure of teaching and learning. These are, in a sense, planning professions, also.

In the old paradigm, planning is carried out by people who have little time, training, aptitude or professional support for their work. In the new paradigm, all planning professions would have entry requirements, an apprenticeship or "induction" process, a professional society, a professional development framework, and a growing technical culture grounded in basic research.

However, these new professions are not generally recognized, and the scale of our educational problems overwhelms the current individual achievements of the new professions. Furthermore, the federal-level framework enabling our overall education system to benefit from the best of the plans being produced by these professions is very weak due to its poor design*(25)*.

In the new paradigm, all the planning professions would be expected to test their designs and **redesign** them in response to testing to be sure that they are successful across a broad range of teachers, students, and institutions.

Unfortunately, in the present system, there is little support to complete such tests properly*(5)*. However, there must be a way to address the myriad shortcomings of the totality of advanced planning--from materials to professional development to curriculum to the mentoring process for expanding a network of restructured schools. Plans are never perfect; they can always be incrementally improved based on experience*(26)*.

Where to Start

How do we begin the move from the paradigm that currently exists in United States education to a new one of the kind I have suggested? One early step I envision is the selection of a small number of institutional champions of the new paradigm--institutions that have both the capability and the willingness to be among the first to dare to make it work*(6)*. These institutional champions would be offered major planning assistance in return for undertaking a multiple component challenge.

First, the champions would make an immediate clean break with the current paradigm. For example, they would pioneer a sustained professional development framework in which teachers, administrators, parents and others begin to pursue a global technical culture for each of their professions, begin to define the graded steps of apprenticeships for each profession, and begin to identify heroes and their exploits that will help justify these steps.

The second part of the challenge would be to demonstrate (after several years for planning and testing) a new daily schedule for teachers and students at an operating cost per student that can be as low as twenty percent lower than

typical sister institutions without disrupting the essence of the new paradigm. In the case of champions among universities, I am talking about teaching costs only, not the costs of research or public service.

The second part of the challenge makes no sense unless one accepts just how grim the present situation is. The basis for the challenge is that with enough high quality professional development, available to the students as well as the faculty, the abundance of teaching by students should become more effective than the teaching now being provided in most classrooms at any level. A typical student should benefit more from several hours of coaching per day by students, coupled with overall guidance and some direct teaching from a teacher or professor, than the few extra minutes of personal attention from the faculty that the present paradigm offers. This should be especially true given that current faculty have had no such professional development and are often too stressed to be helpful to all students. Furthermore, by relieving teachers or professors of much of their current classroom hours and/or busywork, and not counting out the minutes of personal attention per student from them, the costs of instruction can be reduced if necessary, rather than increased. One reason for reducing these costs, besides the need to serve unmet workforce training needs, is to leave about twenty percent of the instructional budget to pay for not only classroom supplies but outside services, including the new and necessary planning services.

The institutional champions would establish long term supplier contracts with groups supplying professional designs, including educational architecture, instructional design, and professional development which meet high quality standards. The institutional champions would each need the leadership of an

education systems integrator to build a coherent education plan pulling together the plans of numerous suppliers. They would likely be heavily dependent on the quality of their suppliers' offerings to achieve highly effective instruction despite the brutal restriction I have suggested for operating costs. In consequence, they should demand the same inspired level of quality in planning and professional design as professional musicians demand from composers of the music they perform.

Another requirement of the institutional champions would be to organize a redesign process. This would become important after their initial implementation of a new paradigm, which would have included the build-up of a network of suppliers, and another network of sister schools adopting the new paradigm. In the redesign process, all aspects of the planning and operations of all the schools in their network would be examined and priorities set for redesign; then the planning suppliers, in consultation with school staff, would develop a new generation of plans in response to these priorities. The goals of the redesign would be higher quality of instruction, higher reliability across the full range of schools, teachers, and students in the network, and lowered unit costs for a given amount of learning by students. Redesign would occur periodically and with sufficient frequency so that there develops growing expertise with school system redesign as a continuing process. This expertise is non-existent today because the last full system redesign took place a century ago*(1)*.

It is especially important that budgetary pressures on education be responded to with intelligent planning through the build-up of the redesign capability rather than placing catastrophic burdens on operating personnel. This is one of the

most important reasons for building a planning capability for education rather than acceding to pleas of teachers and professors that they can handle all the planning themselves without outside help.

For twenty years of planning to pay off, many schools must benefit. However, because of the huge number of schools in the United States, if each of them eventually devoted twenty percent of their budgets to purchasing planning services, the total budget nationwide for planning would grow to the neighborhood of forty billion dollars a year. These funds could in turn enable a very large number of plans to be tested and redesigned to an extraordinarily high level of quality. Because of the enormous potential payoff of widely shared, high quality plans, I would urge that the initial institutional champions have major government subsidies to support their contracts with their planning suppliers. One source of these subsidies might be the federal Chapter I program for disadvantaged students, for example to fund institutional champions chosen from Chapter I schools.

Many educators will find the cost reduction challenge, by drawing on student help in teaching, unachievable based upon their own, very valid experience. However, I envision the champions drawing on nationwide craft experience with peer tutoring*(13)* as well as educational research*(5)* (such as cooperative learning(*15)*), neither of which is part of daily experience in most schools. Furthermore, there is a far broader opportunity here, in return for sufficient investment in planning. There exists the opportunity to use a variety of human collaborations and a variety of computer technology applications to enhance learning at low cost. Human collaborations not yet mentioned include team teaching across different subjects and the more general notion of "interactive

professionalism" discussed by Fullan*(2)*. Computer technology applications include electronic communications, visual displays, word processing, computations, access to electronic information, and distance learning. Table II lists eleven (!) underutilized resources *(11)* for United States classrooms However, the task of bringing all these opportunities to fruition in integrated reform plans adds to the burden on the education systems integrators, the institutional champions, and their suppliers.

To compensate for the exceptional difficulties disadvantaged minorities encounter with our present system of education *(27)* I urge that institutions which have high percentages of such students be over represented (not underrepresented) among the initial champions of the new paradigm.

Unfortunately, there is a missing element in this discussion, namely, reliable and thorough third party evaluation (comparable to Stevenson and Stigler's work) of current long-standing reforms and the plans they have developed. A very high priority, I believe, should be given to strengthen basic research and advanced training in evaluation nationwide. For example, Stevenson and Stigler's work was itself basic research funded by the National Science Foundation and the National Institute of Mental Health, and more support for programs of this quality is needed*(5)*.

Evaluation, Feedback, and Proliferation

Among the numerous disasters in the present system, one is the constantly changing priorities in the endless layers of management above individual classrooms. These priorities change whenever a principal, superintendent,

school board, university provost, chief state school officer, governor, secretary of education, or president is replaced. It is rare that the priority changes are related successfully to classroom problems, the ongoing efforts to address them, or sensible visions of the future. The result of these changing priorities is constant chaos in the classroom (teachers I know talk about TYNT--"This Year's New Thing".) College and university classrooms are more protected from this chaos by the rock-ribbed conservatism of most faculty. However, I personally spent a year in a physics course that had been reformed but turned into a disaster after its designers moved on, because inadequate planning left it in unsustainable form.

In the new plan, there are two feedback loops that would be permanent features of the system, independent of short term priority shifts. The first feedback loop is the apprenticeship for future teachers and professors. They would benefit, starting at an early age, from the professional development of the present school and college faculty. This means that the next generation of faculty would start their careers far better prepared than the current generation. This in turn would give a further boost to the second following generation of apprentices. The second feedback loop is the redesign process based on field testing of plans including, but not limited to, professional development planning and evaluation based on classroom assessments and student experiences. Both feedback loops depend, for their success, on accurate information on problems that need to be addressed.

Adoption of <u>any</u> new paradigm by the bulk of the schools and higher education institutions in the United States is one of the long-unsolved problems of reform. However, I suggest the following major effort to achieve the adoption of the

proposed new paradigm for education. The initial institutional champions would foster an expanding network of client schools by an intensive mentoring process. This would be similar to the facilitation process already in use by the school restructuring programs cited earlier but with far more resources and support devoted to each new institutional recruit than is the case today. The mentoring would start with paid, year-long sabbatical leaves for faculty from potential client schools. They would help with both teaching and planning in the champion institution, as well as participating fully in professional development. Another aspect of the mentoring process would be peer-to-peer relations between client schools and schools already in the network, as each client school goes through the difficult restructuring process to move to the new paradigm. A heavy investment in the mentoring process would be needed but could, if necessary, be compensated for by reduced operating costs after the transition.

In agreement with the National Goals, a plan for assessment of schools is emerging, to be based on national and state standards for student outcomes*(1)*. However, the work of Stevenson and Stigler shows that classroom evaluation is at least as informative as student assessments. In my new paradigm, I would use classroom evaluation and student experiences with learning, to drive improvements on an equal basis with standards. Education would become a demand-based system in which student's experiences, judged by students themselves with the help of third party evaluators, would play a vital role. I would have this demand start with adults returning to school because of their inadequate education. Younger students would be exposed to the needs of these adults by serving as teaching assistants in adult education as part of their

twenty year teaching apprenticeship (either as individuals or in teams)*(28)*. A top priority in the evaluation of student experiences would be the quality of these experiences, rather than curriculum coverage, until education planning is sufficiently developed so that quality is not a rare commodity anymore and standards (other than the well received mathematics standards of the NCTM)*(29)* have had a chance to mature. The professional development programs would likewise be judged by the teachers they serve, again on an equal basis with standards. To ensure this focus, schools would be subsidized to contract for professional development and other planning services rather than having these services depend directly on grants. The main purpose of all this evaluation would be to help provide feedback for redesign.

A school being recruited for a champion's network would see constant quality improvement and unit cost reduction within the network schools while it largely stands still. Given time, this type of message is difficult to resist, as I found from watching personal computers penetrating large organizations dominated by mainframe computing systems in politically powerful centralized computing centers. However, schools would be free to choose to join any network or to remain isolated, although they would remain under strong pressure to achieve statewide standards.

Finally, while evaluation teams would be thoroughly and professionally trained, their membership would be drawn predominantly from the type of community a given school or other institution serves, so that the culture and needs of the community receive full attention in the evaluation. To ensure the necessary diversity among professional evaluators, any basic research initiative in

evaluation should include multi-year traineeships for promising recruits from the diverse populations of today's communities.

The Problem of Research Universities

I used to blame myself for my inadequate teaching skills compared to those of Arnold Arons*(20)*, a personal friend. But after attending a college-level cooperative learning workshop (offered by an associate of the Johnsons*(15)*), observing a Reading Recovery teacher professional development session*(23)*, and observing "Physics by Inquiry" classes utilizing Lillian McDermott's inquiry modules*(19)*, I blame a research university culture which sent me off to my first graduate teaching experience with a text book, a class list, and a room assignment. I was introduced to heroic feats of physics research, mountaineering, and international folk dancing, but not heroic feats of teaching. I was supported by colleagues engaged in research, but was not part of an interdisciplinary team counseling students and guiding them to a broad liberal education. There are now growing efforts to provide modest help to beginning teaching assistants*(30)* but they have yet to be as comprehensive as the apprenticeship I recommend. In addition, a key barrier to college level teacher education, and a problem in other respects, too, is the over-specialization of faculty. To counter this, I suggest adding a new top rung to the academic career ladder, called perhaps "University Professor", for which there would be an interdisciplinary breadth requirement*(31)*. Moreover, since research university faculty often provide continuing education to America's leaders, which requires extraordinary breadth and vision, I recommend that the teaching apprenticeship for these faculty only end with successful promotion to University Professor.

The growth of the planning professions will escalate the need for basic social science research in universities to support planning*(5)*. There needs to be a comprehensive effort to upgrade the quality of much of this research to match the achievements of key references to this paper.

Colleges, schools, and departments of education would be drastically transformed and upgraded, in both quality and responsibility, in the new paradigm. Few faculty understand that these entities now suffer from the problems the Julliard School of Music would have if its students arrived unable to play their instruments. An influx of students with prior teaching experience should help drive the transformation.

Conclusion: New Wisdom for Old Problems of Reform

The problems addressed in this paper are of long standing. John Amos Comenius, an early advocate of universal education, wrote in 1632, "Let the main object of this, our Didactic, be as follows: To seek and find a method of instruction, by which teachers may teach less, but learners learn more; . . ."*(32)* William James, in 1903, wrote, "Will anyone pretend for a moment that the doctor's degree is a guarantee that it's possessor will be successful as a teacher?" My final quote is "For more than a hundred years much complaint has been made of the unmethodical way in which schools are conducted, but it is only within the last thirty that any serious attempt has been made to find a remedy for this state of things. And with what result? Schools remain exactly as they were." This quote is three and a half centuries old, being due again to Comenius.

In contrast, the understanding needed to address these problems has developed only recently, mostly through research and careful observation which is documented in the references of this paper and the literature they refer to. Much of this understanding comes from attempts at school reform including reflection on the most recent thirty years of failure. The bulk of education reform, until recently, has resembled the Ptolemaic approach of piling equants on top of deferents on top of epicycles*(33)* instead of seeking a new starting point, a new set of priorities which would ease the problem. University reform is less developed and I find writings about it less convincing.

With the commitment to the National Goals, the United States has, I believe, backed itself into a corner. All the evidence demonstrates that the National Goals are unachievable unless lifelong, sustained professional development becomes the top priority of faculty in schools and higher education, replacing endless hours of unproductive class time. But instead of planning for such a system, we have glorified the piecemeal reform project, including disconnected one hour to two week workshops that mostly leave schools "exactly as they were."

It is time to focus scarce financial and human resources on just a few "institutional champions." These champions, in return, would provide initial demonstrations of a new paradigm in operation and than facilitate growing networks of sister institutions also making the paradigm shift. These champions need to benefit from the wisdom of the leaders of the small cadre of emerging planning professions, both the leaders I have met and cited and those I have yet to locate or calibrate. They would inaugurate the feedback loops critical to sustained educational improvement.

I urge readers who are not already education reform experts not to respond to this paper by reaching for a word processor to write yet another piecemeal reform grant proposal, but instead to read the literature (such as the references in this paper) and to verify the documentation I have cited through direct observation of classes and off-the-record discussions with students, faculty, administrators, colleagues, political representatives, and neighbors. I know of no other way to build a constituency that will press for an intelligent re-ordering of priorities in education instead of continuation of the business as usual or, what would be worse, pressing for a more limited but doomed implementation of the National Goals. This constituency has to cross many boundaries with linkages across disciplines, across diverse populations, across grade levels, and across public and private sector boundaries. This constituency has to plan for the reallocation of current resources to support new priorities rather than expecting all change to be predicated on new dollars. Furthermore, this constituency has to become a counterforce to the bulk of the population who are either indifferent to the problems of education reform or, what is worse, have falsely assigned blame for the present problem and are now demanding a quick fix by the people they have blamed.

It is depressing to read the literature I have cited unless one has a belief that there exists a way to resolve the deep and long standing problems discussed in this paper. The concepts presented here of a twenty year apprenticeship, an altered teacher's and student's day, growth of the planning professions, changes in the research university, and feedback loops informing redesign drawing on demand-based evaluation, are all intended to contribute to such an optimistic belief. However, in order to help readers build this belief, I have had

to simplify -- to simplify both what I myself learned as well as ignoring problems I did not study. The initial champions will not have this luxury; they will need both our full support and our full patience in order to succeed. Success should, however, be worth both this support and patience. One major goal that success should bring within reach is the dream of an educated, democratic state, with education being sufficient to enable all of us to understand as well as share ownership in today's complex national decisions that affect all our lives*(34)*.

TABLE I
The New and Old Paradigms

Components*	Old Paradigm	New Paradigm
Function of Education	Prepare students mostly for rote jobs; a fraction become professionals	Prepare all students for lifelong learning & living in complex, diverse, technological, democratic society
Foundation for Learning	Basic skills: the three "R's"	Workplace*(1)*, living, and citizenship skills
Teacher Education	Mostly in college	20 year apprenticeship mostly in school, plus college and experience
Professor Education	None	Apprenticeship in school and college, plus work experience
Faculty Knowledge Base	Breadth OR depth	Breadth AND Depth
Top priority for faculty	Meet with classes	Professional development, working with apprentices, leadership of learning
Instruction	Faculty teaching students	Faculty coaching faculty to coach students to coach students
Classroom "Learning Unit"	Individual students, each with textbook, worksheet, etc.	Cooperative learning group, peer tutor, personal computer, materials, and supplies
Planning	By temporary part-time committees, or individual faculty, if time permits	Domain of the planning professions
Start-Up & Proliferation	All institutions change at once, independently	A few champions who found expanding networks
Evaluation and Assessment	Standardized, periodic tests	Third party evaluation in the classroom
Basis for Improvement	Inadequate test scores	Student demand, informed by adult experience, jointly with standards
Feedback & Improvement	Piecemeal improvements in a disjointed system	Coherent redesign across each network; led by Education Systems Integrator; also the 20 year apprenticeship

*This list is still incomplete: see reference *(7)* for yet other components already proposed

TABLE II

Inexpensive, Underutilized Resources for United States Classrooms

Resource	Nature/Cause of Underutilization
Exemplary Faculty (also Principals, etc.)	Expertise Not Shared
Exemplary Reforms	Unevaluated, Not Widely Known
Students	Not Used in Teaching
Bulk of teaching force	Inadequate Professional Development
Community Volunteers	Not Encouraged
Collaboration Among Faculty	Time Alone in Class
Technology	Inadequate Investment in Software
Participatory Management (e.g., TQM)	Inadequate Profession Development of Faculty
Experience from Foreign Classrooms	Not Invented Here Syndrome
Integration Across Subject Areas	Inadequate Professional Development, Materials, Not Encouraged
Cooperative Study by Students Outside Class	Inadequate Professional Development of Faculty

(Inspired by Sarason, The Culture of the School, 1982)

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1. For the economic and social problems behind the National Goals for Education, see R. Marshall and M. Tucker, Thinking for a Living. (BasicBooks, New York, 1992). For workplace skills, see, e.g., What Work Requires of Schools (United States Department of Labor, Secretary's Commission on Achieving Necessary Skills, Washington, 1991).

2. For an overall perspective on barriers to reform, see M. G. Fullan and S. Steigelbauer, The New Meaning of Educational Change (Teachers College Press, New York, ed. 2, 1991). For a disciplinary perspective and further problems, see Committee on High-School Biology Education, Fulfilling the Promise (National Academy Press, Washington, 1990). For one minority perspective see Education that Works: An Action Plan for the Education of Minorities (Quality Education for Minorities, Washington, 1990). For existing fundamental weaknesses see C.E. Silberman, Crisis in the Classroom: The Remaking of American Education (Random House, New York, 1970), which is greatly reinforced in Goodlad, J.I., A Place Called School (McGraw-Hill, New York, 1984).

3. A summary of this project is available from the Ohio Board of Regents, Columbus, Ohio 43266.

4. I thank especially Donald Anderson, Patricia Blosser, Carolyn Carter, Diane DeFord, Carol Lyons, Victor Mayer, Alan Osborne, Gay Su Pinnell, Victor Rentel, and Nancy Zimpher.

5. See R. C. Atkinson and G. B. Jackson, eds., Research and Education Reform: Roles for the Office of Educational Research and Improvement (National Academy Press, Washington, 1992).

6. T.S. Kuhn, The Structure of Scientific Revolutions (University of Chicago Press, ed. 2, 1970).

7. One example is Ohio's one page handout An Invitation to the Future: Rising Expectations and Achievement, which lists ten components of their new paradigm, including high expectations for all students replacing grading on a curve, as well as coaching for understanding replacing coverage of material and memorization.

8. H. W. Stevenson and J. W. Stigler, The Learning Gap: Why our Schools are Failing and What we can Learn from Japanese and Chinese Education (Summit, New York, 1992), and H. W. Stevenson, C. Chen, and S.-Y. Lee, Science 259, 53 (1993).

9. D. Lortie, Schoolteacher: A Sociological Study (University of Chicago Press, Chicago, 1975).

10. See the Academy report of Ref. (2).

11. S. Sarason, The Culture of the School and the Problem of Change (Allyn and Bacon, Boston, ed. 2, 1982).

12. See (1). Also, Maynard C. Reynolds, ed., Knowledge Base for the Beginning Teacher (Pergamon, New York, 1989) and S.B. Sarason, The Case for Change: Rethinking the Preparation of Educators (Jossey-Bass, San Francisco, 1993).

13. See, e.g., A. Gartner, M.C. Kohler, and F. Riessman, Children Teach Children: Learning by Teaching (Harper and Row, New York, 1971) and L. Martz, Making Schools Better (Times Books, New York, 1992), Chapter 4.

14. See, e.g., T. P. Hughes, American Genesis (Penguin, New York, 1990) for how lowered automobile prices by Henry Ford combined with insatiable demand caused job growth.

15. See, e.g., D. W. Johnson, R. Johnson, and K. Smith, Cooperative Learning in the College Classroom, (Interaction Book Co., Edna, MN, 1989) and R. Slavin, Cooperative Learning: Theory, Research, and Practice (Prentice-Hall, Englewod Cliffs, NJ, 1990).

16. See, e.g., Fullan (Ref. (2)) and S. Sarason, The Challenge of Art to Psychology (New Haven: Yale University Press, 1990).

17. See, e.g., S. Sarason, Letters to a Serious Education President (Corwin Press, Newbury Park, CA, 1993).

18. See, e.g., Sarason (16) and W. Glasser, The Quality School: Managing Students Without Coercion (Harper and Row, New York, 1990).

19. L. McDermott, American Journal of Physics 58, 734 (1990). The glory of her Physics by Inquiry course for elementary and middle school teachers is a set of text modules for use in class which define open-ended experiments and carefully chosen questions for the students, but no answers!

20. See Ref. (7) and A. Arons, A Guide to Introductory Physics Teaching (Wiley, New York, 1990). The chapters on science literacy and critical thinking are especially valuable.

21. R. E. Slavin, N. A. Madden, N. L. Karwiet, and L. J. Dolen, Success for All: A Relentless Approach to Prevention and Early Intervention in Elementary School (Education Research Services, Arlington, VA, 1992).

22. See, e.g., the programs of Comer, Sizer, and Levin discussed in E. B. Fiske, Smart Schools, Smart Kids: Why do Some Schools Work? (Simon and Schuster, New York, 1991).

23. See, e.g., D. E. DeFord, C. A. Lyons, G. S. Pinnell, Bridges to Literacy (Heinemann Educational Books, Portsmouth, NH, 1991). The glory of Reading Recovery is their one year professional development program

for teachers-preparing them to provide one-on-one tutoring for first graders at risk of failure in reading, as well as the support system which enables sixty percent per year growth of the program.

24. I have invented some of the names of these professions, to serve as temporary place holders until permanent names are agreed upon. Fullan(2) has summarized some professional preparation needs for many of these professions. Instructional design dates back at least to major science curriculum projects of the 1960's: see the Academy report in (2).

25. The federal support system for educational research and development, combining centers for research and development, regional educational laboratories to convert research findings into packaged school reforms, and a dissemination arm (the National Diffusion Network) never had the impact Congress intended because it lacked feedback loops from the field(5). Furthermore, its success was limited because without a professionalized teaching force with a long apprenticeship, there was no demand from the field to support build up of the planning professions which in turn are needed to build demand for basic research in education. Support for research in the natural sciences and medicine depends crucially on needs from corresponding planning professions engaged in engineering research and development or medical clinical research and technology development, respectively. The plan of this paper would greatly enhance the need for education research: see (5) for a plan to strengthen federal support for such research.

26. Marshall and Tucker(1) endorsed an outcomes-based paradigm based on the National Goals without reference to the unsolved issues of planning and other problems raised in this paper. They justified their endorsement based on the restructuring already achieved at Xerox and the achievements of Jaime Escalante. Unfortunately, Xerox already had major planning expertise in its research and development and its marketing organizations. These planning organizations bring about widespread changes at Xerox on a periodic basis each time new models of copiers or other major products are released. United States private industry has invested well over 500 billion dollars in just the R and D component of such planning since 1960. (see, e.g. National Science Board, Science and Engineering Indicators - 1989 (United States Government Printing Office, Washington, 1989)) Restructuring is much more difficult when there are no dollars or qualified people assigned to plan for it (see, e.g., the National Academy of Sciences report in (2)). Jaime Escalante taught calculus to high ability advanced placement students only, which is no proof that teachers can bring all students in a school through equally challenging subjects without major support for planning and professional development.

27. See, e.g., Quality Education for Minorities (2).

28. For a cogent discussion of school reform based on standards of professional practice in schools, not just assessment of outcomes, see L. Darling-Hammond, Standards of Practice for Learning-Centered Schools (unpublished report, National Center for Restructuring Education,

Schools and Teaching, Teachers College, Columbia University, New York, 1992). But I suggest more, namely that the high performance end of the workplace(1) is changing so rapidly that students need to experience it directly so that they can demand an education consistent with it. The educational bureaucracy, in my experience, is too cumbersome to keep up with workplace changes otherwise. See, e.g., T. Peters, Liberation Management: Necessary Disorganization for the Nanosecond Nineties (Alfred A. Knopf, New York, 1992).

29. Curriculum and Evaluation Standards for School Mathematics (National Council of Teachers of Mathematics, Reston, VA, 1989).

30. See, e.g., L. M. Lambert and S. L. Tice, eds., Preparing Graduate Students to Teach: A Guide to Programs that Improve Undergraduate Education and Develop Tomorrow's Faculty (American Association for Higher Education, Washington, 1993). For a thoughtful review, see Bernard Berelson, Graduate Education in the United States (McGraw-Hill, New York, 1960). See also Silberman (2).

31. Changes to the university structure to benefit teaching and interdisciplinary depth are more likely to be supported in private than in public by university faculty, especially if clumsy reform plans (as clumsy as typical school reform plans(2)) are imposed on them. A useful background book is S. Sarason, Work, Aging, and Social Change: Professionals and the One Life, One Career Imperative (The Free Press, New York, 1977).

32. All three quotes cited here are reprinted in Silberman (2).

33. See, e.g., T.S. Kuhn, The Copernican Revolution: Planetary Astronomy in the Development of Western Thought (Harvard University Press, Cambridge, 1957).

34. I am grateful to a large number of people who helped me learn a vast field far removed from my own training. I thank the many members of Project Discovery, including Co-Directors Jane Butler Kahle, E. Garrison Walters, and Nancy Eberhart, my own Director Constance Barsky, as well as Suzanne Lea, Johnny Hill, Robert Brown, Sigrid Wagner, and the Project Discovery Northeast Leadership Team. I thank all my fellow members of the Committee on the Federal Role in Educational Research of the National Academy of Sciences-National Research Council (Richard Atkinson, Lawrence Badar, G. Carl Ball, James Banks, Katherine Bick, David Cohen, C. Larry Hutchinson, Beverly Jiminez, Charles Manski, Paul Peterson, Andrew Porter, Albert Quie, Marilee Risk, and Carol Weiss) and the staff director Gregg Jackson for this committee(s). I thank Leonard Jossem, Alexandra Wigdor, David Robinson, Manuel Gomez, Johnny Lott, Jack Lochhead, Richard Celeste, Lillian McDermott, Robert Slavin, Seymour Sarason, Michael Fullan, Carl Smith, and Marie Clay. I thank Bennett Daviss, co-author with me of a forthcoming book. Arnold Arons has been my mentor on educational reform for over thirty-five years. Alison Brown has helped me greatly as always. I am very grateful to Steven Katz for help in completing the manuscript and to Sharon Kraft and Lorri Laudermilt for their patient secretarial help.